

## **Summary**

During the fall of 2011, William England, Ph.D., Universal Service Administrative Company (USAC) Senior Director of Rural Health Care Evaluation, contacted on behalf of USAC six telehealth subject matter experts (SMEs), representing approximately 1,660 rural health care providers (HCPs). Specifically, USAC was seeking information concerning HCP bandwidth usage and participation in the federal Rural Health Care Support Mechanism (Rural Health Care Program). Questions posed to the SMEs and answers are provided in the attached appendices.

The SMEs consistently indicated that radiology applications were the primary driver of need and electronic medical record (EMR) systems might require significant bandwidth as new systems were implemented. The SMEs also noted that EMR systems have high system reliability and redundancy requirements. Further, the SMEs indicated a concern that redundant systems are needed to support EMR systems suggests that single vendor or single modality broadband solutions may not fully meet HCP needs.

Several SMEs noted that high bandwidths were not available in rural areas at a “reasonable price”, even including support from the traditional Rural Health Care program (Primary Program). The SMEs provided comments on obtaining funding for build-out of broadband facilities and services. One SME commented that an HCP participating in the Rural Health Care Program would have preferred a 10 Mbps Ethernet solution, but instead used eight bonded T-1s because the \$30,000 construction charge for Ethernet would not be paid by the Primary Program.

Several experts commented on the lack of scalability of broadband. Although services below T-1 may be much more expensive per megabyte than a T-1, there is no economy of scale in buying multiple T-1s (*i.e.*, the price per T-1 remains the same). One SME with experience in both the Primary Program and the Rural Health Care Pilot Program (Pilot Program) noted that several HCPs were hesitant to participate in the Pilot Program because their urban rate for a T-1 reflected a discount of over 85 percent, making participation in the Pilot Program more costly than the Primary Program. SMEs also noted that when 10 Mbps Ethernet becomes available, higher bandwidths may be available at significant economies of scale, so HCPs can jump to even higher bandwidths at minimal additional cost.

Another problem observed regarding scalability of broadband solutions, and an important reason for studying and creating better health care bandwidth demand models, is the need to rapidly rescale a solution when new uses place unexpected demand on a system. For example, one new clinical application or user can tip the balance of speed such that all users see an unacceptable degradation in performance. One SME suggested that the

number of doctors may be a good predictor of need, with approximately 10 Mbps needed for every three doctors.

An SME also commented on parity among multiple HCPs. If practitioners work with multiple HCPs, they may expect equal performance or capability at all sites, so there may be reasons to establish a standard for all clinics rather than customize solutions for individual sites. That may increase the cost relative to a piecemeal approach to upgrades where they can be done less expensively. But it also can be a market power (bulk buying) strategy that is being used effectively in some Pilot Program projects to achieve postalized rates for outlier sites.

Several SMEs commented that broadband is needed not just for health care facilities but also for follow-up and care for patients in their homes. Because the Rural Health Care Program does not support broadband for homecare, such needs were not part of this assessment, but are an important consideration for HCPs.

Experts were also asked how the Rural Health Care Program could better meet their needs other than for more bandwidth or funding. Several commented on cash flow and the amount of time it takes to be reimbursed if the HCP paid in full when service was delivered. SMEs also indicated that the urban/rural rate difference (the telecommunications discount in the Primary Program) seems to favor T-1s and lower bandwidth solutions.

Appendix A below provides a compilation of the estimates provided by the SMEs on the bandwidth needed for different types of telehealth services. Appendix B lists the SMEs who contributed to this report. Appendix C provides the responses from the SMEs to questions posed by USAC.

**Appendix A: Estimated Bandwidth Needs for Telehealth Services**

Health Care Use or Service	Minimum bandwidth (Mbps)			Typical bandwidth (Mbps)			Optimal Bandwidth (Mbps)		
	Low	Avg	High	Low	Avg	High	Low	Avg	High
<b>Video Conferencing (non-HD)</b>	0.4	<b>1.0</b>	1.5	0.4	<b>3.5</b>	10	0.8	<b>14</b>	50
<b>Video Conferencing (HD)</b>	1.0	<b>1.5</b>	2.0	1.0	<b>8.1</b>	23	1.5	<b>22</b>	50
<b>Administrative Use</b>	0.4	<b>1.1</b>	1.5	0.4	<b>3.5</b>	10	0.8	<b>13</b>	50
<b>Cardiovascular/Echo cardiology</b>	1.0	<b>3.4</b>	9.5	1.0	<b>6.4</b>	10	1.5	<b>18</b>	50
<b>Dentistry</b>	0.4	<b>1.0</b>	1.5	1.0	<b>3.2</b>	10	1.0	<b>14</b>	50
<b>Dermatology</b>	0.4	<b>1.3</b>	2.0	1.0	<b>3.4</b>	10	1.5	<b>12</b>	50
<b>Dialysis/ESRD</b>	1.0	<b>1.4</b>	1.5	1.0	<b>5.3</b>	10	1.5	<b>21</b>	50
<b>Electronic Medical Records</b>	1.0	<b>1.4</b>	1.5	1.0	<b>7.6</b>	14	1.5	<b>22</b>	50
<b>Emergency Rm/Trauma Care</b>	0.4	<b>6.9</b>	27.0	1.0	<b>9.0</b>	27	1.5	<b>32</b>	100
<b>Gastroenterology</b>	1.0	<b>1.4</b>	1.5	1.0	<b>5.3</b>	10	1.5	<b>21</b>	50
<b>Obstetrics/Gynecology</b>	1.0	<b>1.4</b>	1.5	1.0	<b>4.5</b>	10	1.5	<b>18</b>	50
<b>Orthopedics</b>	0.4	<b>1.1</b>	1.5	1.0	<b>4.2</b>	10	1.5	<b>16</b>	50
<b>Pathology</b>	1.0	<b>1.4</b>	1.5	1.0	<b>4.4</b>	10	1.5	<b>16</b>	50
<b>Physical Therapy</b>	0.4	<b>1.1</b>	1.5	1.0	<b>4.2</b>	10	1.5	<b>16</b>	50
<b>Primary Care</b>	0.4	<b>1.1</b>	1.5	1.0	<b>4.2</b>	10	1.5	<b>16</b>	50
<b>Psychiatry &amp; Counseling</b>	0.4	<b>1.2</b>	1.5	0.8	<b>3.4</b>	10	1.0	<b>14</b>	50
<b>Radiology - MRI/CAT</b>	1.0	<b>4.6</b>	10.0	1.0	<b>9.0</b>	20	1.5	<b>34</b>	100
<b>Radiology - X-ray</b>	1.0	<b>3.1</b>	10.0	1.0	<b>7.5</b>	20	1.5	<b>33</b>	100
<b>Rehabilitation</b>	1.0	<b>1.4</b>	1.5	1.0	<b>5.3</b>	10	1.5	<b>21</b>	50
<b>Remote Monitoring</b>	1.0	<b>3.5</b>	10.0	1.0	<b>6.5</b>	10	1.5	<b>40</b>	100
<b>Specialist Care</b>	0.4	<b>5.5</b>	23.0	1.0	<b>8.0</b>	23	1.5	<b>17</b>	50
<b>Speech Therapy</b>	0.4	<b>1.2</b>	1.5	1.0	<b>3.8</b>	10	1.5	<b>15</b>	50
<b>Training/Education</b>	0.4	<b>1.2</b>	1.5	0.6	<b>3.2</b>	10	0.8	<b>12</b>	50
<b>Ultrasound</b>	1.0	<b>1.4</b>	1.5	1.0	<b>5.3</b>	10	1.5	<b>21</b>	50
<b>Average</b>	0.7	<b>2.1</b>	4.9	0.9	<b>5.4</b>	13	1.4	<b>20</b>	58

**Appendix B: Contributing Subject Matter Experts**

<b>Name</b>	<b>Title</b>	<b>Approximate USF Applicant Sites Represented</b>
Earl W. Ferguson, MD, PhD, FACC, FACP, FACPM	Director of Southern Sierra Telehealth Network 1539 N. China Lake Blvd., Suite A Ridgecrest, CA 93555	880
Thelma Armstrong	Director Eastern Montana Telemedicine Network 2800 10th Avenue N Billings, MT 59101-0703	26
Scott Simmons, MS	Director of TeleHealth University of Miami Miller School of Medicine 1150 NW 14th Street (R-350) Professional Arts Center, Suite 206 Miami, FL 33136	0
Eugene Sullivan	Program Manager Office of Telemedicine, University of Virginia P.O. Box 800707 Charlottesville, VA 22908-0707	86
Jason Wulf MBA, CTP	Senior Financial Analyst Avera Health 3900 W. Avera Dr, Suite 300 Sioux Falls, SD 57108	466
Michael O'Connor	President, USF Consultants PO Box 6641 Monona, WI 53716	200
Total		1658

## **Appendix C: Subject Matter Expert's Responses**

### **Earl W. Ferguson, MD, PhD, FACC, FACP, FACPM**

**As someone who works with many health care providers (HCPs) receiving Universal Service support under the Rural Health Care program, I would appreciate your thoughts or experience concerning the issues below. Please call me if you want to talk instead of writing or if my questions are unclear. If you are active in both the Primary and the Pilot programs, please provide two sets of answers, if they differ.**

COMMENT: I am a practicing cardiologist with a strong interest in rural implementation of advanced HIT applications and have been Executive Director of the Southern Sierra Telehealth Network (SSTN) since I started it with a grant from the California Telemedicine and eHealth Center (CTEC, formerly the California Telemedicine and Telehealth Center) in 2001. We now have five critical access hospitals, an FQHC network, numerous RHCs, other rural clinics and Ridgecrest Regional Hospital (RRH, a 55 bed facility that is applying to become a CAH and has been the rural hub of our network). The SSTN is designed to cover 12% of the land area of California that is primarily frontier and the rest rural. There are only 136,000 people living in this isolated high desert region east of the Southern Sierra Mountains. Our major problem has been adequate broadband connectivity and we would not have made the progress we have made opening up services in our remote area without the Rural Healthcare Pilot Program that funded the California Telehealth Network (CTN) broadband implementation program. My major activity has been with the Pilot programs, but I'm also familiar with the Universal Services support under the Rural Health Care program and have numerous sites in our network that have used and are using the Primary program.

In addition to the above, I am on the Board of Directors of the newly formed California Broadband Collaborative that has a \$101M BTOP grant to lay 100 Gigabit fiber along the Hwy 395 corridor through the remote high desert region of the Eastern Sierras. I am also on other Boards working on advanced HIT or promoting their adoption in rural communities: CTN; California Health Information Services and Partnership Organization (CalHIPSO, the regional extension center that covers all rural areas and most of the rest of California for EHR adoption and is moving us to meaningful use; California State Rural Health Association (CSRHA, I'm the immediate Past-President), we lead CAH assessments last year and developed a low interest loan program through UnitedHealthcare to facilitate rural EHR adoption; RRH Corporate Board & previously Board of Directors. I am a consultant on the national HRSA eICU review in rural areas. I was also previously on the California Health and Human Services eHealth Coordinating Committee; the Library Health Partnership that developed web resources for librarians to assist patients and families with chronic disease management information; the national panel convened by the California Center for Health Policy to develop model telehealth legislation (that lead AB415 [with major assistance from CSRHA] through the California legislature and was just signed by our governor); and a number of other Boards and committees.

- 1. Have you encountered situations where the level of telecommunications or information services that sites need is unavailable? For example, no local carrier offers the service or the needed bandwidth at any cost. Please describe.**

ANSWER: Much of our area has major deficiencies in telecommunications and information services. For example, Eastern Inyo County (the majority of the county) has no cell service – when you drive from Ridgecrest to the east and northeast through Death Valley National Park (DVNP), you lose cell service two miles outside of Ridgecrest, except in the small community of Trona in the remote area of northwestern San Bernardino County that just got cell service last year, and do not regain service until you drive almost three hours through Inyo County (including Death Valley) and approach Pahrump, NV, west of Las Vegas. Furnace Creek and other sites in Death Valley have phone service through a copper wire system that is 50 years old. Shoshone, an hour south of Furnace Creek, is the school center for the region with 70 children bused to the 70-person community each school day. The Death Valley Health Center in Shoshone supports those children and that community on weekdays with a Nurse Practitioner and an administrative assistant. Their Internet connectivity has been “56Kbps on good days” according to the CIO for Clinica Sierra Vista, the FQHC network that staffs that clinic. These are high priorities for CTN connectivity, but getting the connectivity to these sites has been a major problem. These communities cannot be economically serviced with broadband and would never have a chance of service without the efforts we are expending in the CTN and through other venues to try to get them serviced. Even somewhat well connected sites near Hwy 395 do not have quality secondary bandwidth available for backup redundancy. Strands of fiber have not infrequently been cut in the past leaving these sites with little or no connectivity.

- 2. Have you encountered situations where the needed level of service is available but even with RHC support, prohibitively expensive? Have you helped sites scale back on requested service to stay within budget? What problems were caused by bandwidth limits that additional Universal Service funding might solve?**

ANSWER: See answer 1 above. We have explored Satellite Internet services and other options, but those are not satisfactory for real-time interactive telemedicine encounters. Networks with guaranteed quality of service that extend to our geography have been prohibitively expensive until the CTN was established. The only answer is adequate funding for development of fiber or wireless networks to get services to these remote, underserved areas.

- 3. Same as question 2, but could bandwidth restrictions be addressed by changes to forms, procedures, or policies rather than just more funding. Although Universal Service cannot change program policies, clarification of policies or redesign of forms or procedures might be feasible.**

ANSWER: Bandwidth restrictions must be addressed by simplifying forms, procedures and policies to allow more rapid and more cost-effective implementation of broadband. I see how problematic the approval and implementation of broadband and other advanced HIT implementation projects can be. As a contributor to the CTN FCC grant we wrote in 2007 and as an involved member of the Advisory Committee/Board Member/Executive Committee throughout the implementation of the CTN, as well as a rural stakeholder working with sites that need broadband (in the SSTN and other sites), it has been extremely frustrating to get the grant award in early 2008, not have funds released until late 2010 and not start connecting sites until December 2010. WE MUST DO BETTER AND MUST MOVE FASTER! Funding alone will not fix the problem. Simplifying the extensive bureaucratic processes that markedly delay implementation of innovations is much more important.

- 4. Because the Primary program can support the urban/rural difference of any telecommunications service or bandwidth, are their reasons that sites needing additional bandwidth have not upgraded. Does urban rural difference funding seem to favor lower bandwidths? How? Are there scalability issues that prevent “right sizing”. For example, while T-1 is inadequate, 5 or 10 Mbps service is not available and the site cannot justify the urban rate cost step to the next available service such as bonded T-1s, DS-3, Ethernet, or a fiber connection.**

ANSWER: The problem for our region is that adequate bandwidth has not been available at almost any price until recently with the CTN and even CTN is having trouble getting sites like Shoshone connected. When I started the SSTN in 2001, I wanted to use TCP/IP protocols and the Internet (VPNs), but services were so unreliable we had to use ISDN connections. We finally moved up to T1s and bonded T1s at Ridgecrest, then to shared 9Mbps and now the 45Mbps MPLS VPN with the CTN. Our capabilities and reliability for telemedicine encounters have markedly improved. From poor quality interactive video we’ve moved to high quality HVD that markedly improved our ability to assess psychiatric patients, for example. From loss of connectivity in the middle of telemedicine encounters because of connectivity through shared DSLs and other problems, we are beginning to get higher quality encounters. As a cardiologist, I can now access our hospital EHRs and read echocardiograms from my laptop, even when out of town. Echocardiogram studies that previously were of variable quality (interrupted motion and Doppler portions of studies) and took 30-60 minutes to download and read are now high quality and can be read and reported much more rapidly. I was called earlier this month while in a breakout session at the California State Rural Healthcare Association meeting in Sacramento to read a stat echocardiogram. I was able to excuse myself from the meeting, complete the echo reading and report in 10 minutes and get back for questions and discussion. This was not possible even 3 months ago. Some of the CAHs in our region now have shared 45Mbps connections and others have 9-10Mbps connections. Those are major improvements, but the dedicated CTN MPLS network is much better than those connections.



An important related issue is the rapid growth of expectations of broadband connectivity in the last few years. In 2007 when we wrote the CTN FCC grant we expected that most facilities would need T1 lines. Now only remote small clinics can function well with a T1 line. Most hospitals, even small CAHs in our region, expect to need at least a 10Mbps connection and most are opting for 45Mbps connections because of PACS and other functions that require robust, reliable broadband. Shared broadband will be inadequate in the near future because of other community Internet activities, for example NetFlix, competing with the bandwidth for hospital and clinic systems.

**5. Have you worked with HCPs that upgraded service? Were they previously receiving RHC support or was the upgrade made viable by starting RHC support? I am especially interested in health applications that became feasible or worked much better (distinguish) after an upgrade. Was the upgrade in bandwidth, type of service, or both? Brief summaries of bottlenecks eliminated, increased health care service delivery (the system went from 2 to 10 workstations), practitioner efficiency increased, patient volume increased, or other quantifiable benefits.**

ANSWER: I've been working with telehealth/telemedicine applications, EHR implementation and other advanced HIT applications since 1993. The rural 4-6 person primary care clinic where I worked from 1996 to 2007 (I was the only non-PCP) implemented a paperless EHR practice in 2002, e-prescribing in 2004 and an ELINCS laboratory HIE between our clinic and RRH in 2005. In that clinic I was able to combine interactive telemedicine visits with EHRs and PACS image reviews during patient encounters. I left the clinic in 2007 to devote more time to advanced HIT applications. My experience has taught me many lessons about bottlenecks and problems with implementation of these services. First, those services must be built in rural communities based on community needs assessments and a clear understanding and community agreement on the specific needs for those services. Second, services are most efficient when they are built on existing referral patterns to individual consultants (preferably within the immediate region and NOT distant academic medical centers as the first choice). Third, centralized Telemedicine Centers with almost exclusively schedule consultations during regular workday hours, such as the UC Davis model, are not the best way to serve rural communities. Fourth, distributed telemedicine work stations in doctors' offices, EDs and ICUs is a much better model than centralized Telemedicine Centers and UCLA is a much better model than UC Davis. UCLA has 50 independent, well-distributed telemedicine workstations and the number is expanding rapidly. Fifth, one-size-fits-all systems (such as telemedicine carts) being pushed by some university systems are often not cost-effective for rural areas and less expensive systems based on specific needs for each site that can be fielded at half those costs are a much better option. Sixth, many telemedicine/telehealth systems built by academic centers or other large institutions are not serving rural communities adequately because they have built those systems based on their thoughts on the needs of specific rural areas, rather than based on specific rural community needs assessments and a true understanding of the needs of specific rural communities. For example, VISICU/eICU is built for nurses to monitor



trends in vital signs/function through constant monitoring and one-way video into CAH and small rural hospital ICUs. Intensivists and other physician consultants are not available 24/7 for direct consultation with rural physicians. Rural physicians want 2-way interactive video consultations with an expert consultant 24/7 when they need assistance. The rural physicians we've interviewed like the eED model and telePharmacy model that provides them with more direct and readily available information in managing their patients. Last, but not least, last-mile issues are major in isolated rural communities. There is often only one last-mile provider and even with 45Mbps fiber connectivity, problems with single last-mile providers can easily take the system down.

We are moving toward 24/7 connectivity with wireless HDV telemedicine carts in every ED/ ICU/ Holding Unit/ Pharmacy in our region. This will allow us real-time interactions for solving problems and facilitating consultations and case management solutions within our region, but we will also connect to EDs/ICUs outside our region, including UCLA and other large hospitals.

**6. What service types (copper, fiber, DSL, MPLS, Ethernet, etc) and typical bandwidth or range of bandwidths (Mbps) are used by sites you work with.**

ANSWER: Shoshone and Death Valley National Park have copper wire phone service and the DVNP commercial services and EMS have limited broadband. CAHs in our region are moving to shared broadband from 9-45 Mbps – most are also on the list for dedicated CTN MPLS VPN. RRH has dedicated 45 Mbps CTN MPLS broadband, but is still working out last-mile reliability issues (through Verizon). RRH is scheduled for 1Gbps fiber all the way to our facility from the California Broadband Cooperative Digital395 Project that is expected to be operational by the Fall of 2012.

**7. Following is a list of common health services. If possible, please estimate the bandwidth used or appropriate for a site to offer that service. Best guesses are fine...but please note if you have actual experience to support the number. The first two items are regular and HD video conferencing. Some health services may have the same needs as video conferencing, in which case just write video or HD video. The first column asks what minimal bandwidth could support a service. The second column seek typical shared bandwidth for all services at a facility...so if video consulting, radiology, and administration share a DS-3...all three uses would list DS-3 in column 2, although only radiology may need DS-3. That is, shared bandwidth may be less than the sum of individual application bandwidths. If you have multiple clinic scenarios with different bandwidths, list the most common or list them on another page. If you keep records to show how bandwidth is shared, please note. If more bandwidth is needed than currently used or available or you plan an upgrade in the near future, please put that in column 3. Column 3 assumes cost is not an issue, but please don't future proof or include a**

**growth factor to list everything as 10 Gbps. I just want to know what is currently used and if it is currently inadequate.**

<b>Ridgecrest Regional Hospital and Southern Sierra Telehealth Network (SSTN)</b>	<b>Minimum band-width (Mbps)</b>	<b>Typical band-width (Mbps)</b>	<b>Optimal Bandwidth (Mbps)</b>	<b>Comments</b>
Video Conferencing (non-HD)				
Video Conferencing (HD)	T1 for small clinics; bonded T1s for moderate sized clinics and small hospitals	0 to 45Mbps	T1 for small clinics; bonded T1s for moderate sized clinics; dedicated 9-45 Mbps MPLS for hospitals	
Administrative Use	T1 or greater depending on facility and use (VoIP, etc.)		T1 or greater depending on facility and use (VoIP, etc.)	
Cardiovascular/Echo cardiology	9-10Mbps, depending on needs/ services at each facility		9-10Mbps, depending on needs/ services at each facility	Adult cardiology, echo, cardiac CT angiograms, other images Pediatric cardiology, neonatal echo, proctoring techs, stabilization for transport of premature infants, etc.
Dentistry				
Dermatology	T1 for real-time; <T1 for store-and-forward		T1 for real-time; <T1 for store-and-forward	
Dialysis/ESRD				

<b>Ridgecrest Regional Hospital and Southern Sierra Telehealth Network (SSTN)</b>	<b>Minimum band-width (Mbps)</b>	<b>Typical band-width (Mbps)</b>	<b>Optimal Bandwidth (Mbps)</b>	<b>Comments</b>
Electronic Medical Records	At least T1 at clinics; 9-45 Mbps at hospitals, depending on size and activities		At least T1 at clinics; 9-45 Mbps at hospitals, depending on size and activities	Currently RRH & Assoc Clinic EHRs (1 already at MU)/ Lab HIE with hospital lab/ outlying clinics
Emergency Rm/Trauma Care	9-45 Mbps at hospitals, depending on size and activities		9-45 Mbps at hospitals, depending on size and activities	We are implementing HDV 24/7 connectivity among SSTN EDs/ICUs/Pharmacies and out-of-region consultants
Gastroenterology				
Obstetrics/Gynecology				
Orthopedics				
Pathology	T1		T1	Telepathology system implemented at RRH, not fully utilized yet
Physical Therapy				
Primary Care				
Psychiatry & Counseling	T1 or greater		T1 or greater	50+ Telepsych visits weekly in RRH RHC, expecting growth in near future to daily clinic with >100 visits weekly; may need bandwidth for multiple simultaneous interactive HDV visits
Radiology - MRI/CAT	9 Mbps		9 Mbps	Implementation of 24/7 capability for

<b>Ridgecrest Regional Hospital and Southern Sierra Telehealth Network (SSTN)</b>	<b>Minimum band-width (Mbps)</b>	<b>Typical band- width (Mbps)</b>	<b>Optimal Bandwidth (Mbps)</b>	<b>Comments</b>
				cardiac CTAs at RRH for chest pain will push this limit
Radiology - X-ray	T1 or Bonded T1s or greater depending on services and volume		T1 or Bonded T1s or greater depending on services and volume	
Rehabilitation				
Remote Monitoring				
Specialist Care	T1 to 45Mbps depending on size of facilities and services		T1 to 45Mbps depending on size of facilities and services	Variable among SSTN facilities and to consultants outside our region
Speech Therapy				
Training/Education	At least T1		At least T1	RRH LVN to RN and RN to BSN program & other CME and patient health education programs
Ultrasound				

**Thelma McClusky Armstrong, RN, MS**

**As someone who works with many health care providers (HCPs) receiving Universal Service support under the Rural Health Care program, I would appreciate your thoughts or experience concerning the issues below. Please call me if you want to talk instead of writing or if my questions are unclear. If you are active in both the Primary and the Pilot programs, please provide two sets of answers, if they differ.**

- 1) Have you encountered situations where the level of telecommunications or information services that sites need is unavailable? For example, no local carrier offers the service or the needed bandwidth at any cost. Please describe.**

Over the years our network needs have been met by carriers in our region. We are very lucky in Montana to have progressive communication providers that understand the importance of advanced telecommunication to their rural communities. As network demands have increased we have been challenged at times to get the services we wanted at a reasonable price. Three years ago we needed to expand bandwidth to one of our sites. We would have preferred a 10mbps ethernet connection but ended up bonding 8 T-1's. The 10 Mbps service was available at the time but there was a \$30,000.00 construction expense. We are presently negotiating a new contract and the 10 Mbps circuit is now available at a reasonable rate. For the most part we can purchase the bandwidth we need for the Telehealth applications but the affordability is another issue.

One caveat I would mention is that today our network does not provide service into the home. This will be a future need that will be critical in healthcare reform.

- 2) Have you encountered situations where the needed level of service is available but even with RHC support, prohibitively expensive? Have you helped sites scale back on requested service to stay within budget? What problems were caused by bandwidth limits that additional Universal Service funding might solve?**

For our network it is always a delicate balance between network need and what partner facilities can afford. Presently the majority of our network sites are connected by a T-1. This level of service will only support basic applications: standard based video conferencing and limited data transmission. As we roll out electronic health records, remote diagnostic services and HD telemedicine services the need for affordable bandwidth is growing. Unfortunately for our most rural and frontier facilities they cannot afford a significant increase in expense. Presently we cannot offer HD videoconferencing, EHR or remote diagnostics to 70% of our facilities due to ongoing communication costs.

- 3) Same as question 2, but could bandwidth restrictions be addressed by changes to forms, procedures, or policies rather than just more funding.**

**Although Universal Service cannot change program policies, clarification of policies or redesign of forms or procedures might be feasible.**

I do not think that redesign of the administrative process would impact our needs. If there is a way to increase discounts for advanced service that would have a positive impact.

- 4) Because the Primary program can support the urban/rural difference of any telecommunications service or bandwidth, are their reasons that sites needing additional bandwidth have not upgraded. Does urban rural difference funding seem to favor lower bandwidths? How? Are there scalability issues that prevent “right sizing”? For example, while T-1 is inadequate, 5 or 10 Mbps service is not available and the site cannot justify the urban rate cost step to the next available service such as bonded T-1s, DS-3, Ethernet, or a fiber connection.**

It has been my experience that the Primary program supports the use of more traditional bandwidth connectivity. T-1, bonded T-1's and DS3. The urban rate for T-1's provides a very favorable discount. More advanced services are disadvantaged in that the urban – rural rate difference does not provide the needed level of discount.

- 5) Have you worked with HCPs that upgraded service? Were they previously receiving RHC support or was the upgrade made viable by starting RHC support? I am especially interested in health applications that became feasible or worked much better (distinguish) after an upgrade. Was the upgrade in bandwidth, type of service, or both? Brief summaries of bottlenecks eliminated, increased health care service delivery (the system went from 2 to 10 workstations), practitioner efficiency increased, patient volume increased, or other quantifiable benefits.**

We have worked with several HCP to increase bandwidth to accommodate new application and to improve quality of service. Miles City Clinic is one of our busiest telemedicine sites. Due to the clinical volume demands we have increased the number of telemedicine units from one to 3 over the past two years. We partner with that clinic and host their EMR and provide a wide array of remote diagnostic services. We recently contracted for a new 10 MBPS Ethernet connection for that facility. Without the level of service recently we would not be able to provide critical service to this facility. This type of scenario has occurred at 3 other of our network sites in the past year.

The provision of remote services is critical to the short and long term viability of rural and frontier healthcare facilities and providers. Telemedicine services, remote diagnostics and EHR collaboration will be critical healthcare transformation. Our experience is showing us that our rural and frontier healthcare facilities must partner with



larger organization for economies of scale. This can only be accomplished if the infrastructure is available and affordable.

**6) What service types (copper, fiber, DSL, MPLS, Ethernet, etc) and typical bandwidth or range of bandwidths (Mbps) are used by sites you work with.**

For the most part our telemedicine sites are connected by T-1. We have upgraded three of our sites to 10 MPBS Ethernet where needed. We would like to upgrade our smallest sits to 5Mbps so that we could run simultaneous HD telemedicine encounters and have bandwidth for data applications. This issue as always is cost.

**7) Following is a list of common health services. If possible, please estimate the bandwidth used or appropriate for a site to offer that service. Best guesses are fine...but please note if you have actual experience to support the number. The first two items are regular and HD video conferencing. Some health services may have the same needs as video conferencing, in which case just write video or HD video. The first column asks what minimal bandwidth could support a service. The second column seek typical shared bandwidth for all services at a facility...so if video consulting, radiology, and administration share a DS-3...all three uses would list DS-3 in column 2, although only radiology may need DS-3. That is, shared bandwidth may be less than the sum of individual application bandwidths. If you have multiple clinic scenarios with different bandwidths, list the most common or list them on another page. If you keep records to show how bandwidth is shared, please note. If more bandwidth is needed than currently used or available or you plan an upgrade in the near future, please put that in column 3. Column 3 assumes cost is not an issue, but please don't future proof or include a growth factor to list everything as 10 Gbps. I just want to know what is currently used and if it is currently inadequate.**

Health Care Use or Service	Minimum bandwidth (Mbps)	Typical bandwidth (Mbps)	Optimal Bandwidth (Mbps)	Comments
Video Conferencing (non-HD)	384	384	768	
Video Conferencing (HD)				We cannot offer at this time due to bandwidth restrictions
Administrative Use	384	384	768	
Cardiovascular/Echo cardiology				

<b>Health Care Use or Service</b>	<b>Minimum bandwidth (Mbps)</b>	<b>Typical bandwidth (Mbps)</b>	<b>Optimal Bandwidth (Mbps)</b>	<b>Comments</b>
Dentistry	384		1.5 MBPS	All clinical apps should run in HD
Dermatology	384		1.5 MBPS	
Dialysis/ESRD				
Electronic Medical Records				
Emergency Rm/Trauma Care	384		1.5 MBPS	
Gastroenterology				
Obstetrics/Gynecology				
Orthopedics	384		1.5 MBPS	
Pathology				
Physical Therapy	384		1.5 MBPS	
Primary Care	384		1.5 MBPS	
Psychiatry & Counseling	384		1.5 MBPS	
Radiology - MRI/CAT				
Radiology - X-ray				
Rehabilitation				
Remote Monitoring				
Specialist Care	384		1.5 MBPS	
Speech Therapy	384		1.5 MBPS	
Training/Education	384		768	
Ultrasound				

**Jason Wulf**

**As someone who works with many health care providers (HCPs) receiving Universal Service support under the Rural Health Care program, I would appreciate your thoughts or experience concerning the issues below. Please call me if you want to talk instead of writing or if my questions are unclear. If you are active in both the Primary and the Pilot programs, please provide two sets of answers, if they differ.**

- 1) Have you encountered situations where the level of telecommunications or information services that sites need is unavailable? For example, no local carrier offers the service or the needed bandwidth at any cost. Please describe.**

We have had several sites with insufficient facilities which has generally caused delays and increased costs in obtaining the desired bandwidth for TDM services. Several sites have not had fiber available. This is generally the experience in smaller towns.

- 2) Have you encountered situations where the needed level of service is available but even with RHC support, prohibitively expensive? Have you helped sites scale back on requested service to stay within budget? What problems were caused by bandwidth limits that additional Universal Service funding might solve?**

DS3's are very expensive, even with RHC support. The Urban Rate on DS3's is very high, frequently higher than our rural rate resulting in no support. One location that was a potential FCC Pilot site had such a high cost for regular DS1 service that the 15% share was higher than the urban rate in the regular RHC program.

Generally, in the regular RHC program, the urban rate comparison has been very helpful in maintaining reasonable costs at our locations. Cash flow tends to be a concern however as the processing at RHC usually takes a long time.

- 3) Same as question 2, but could bandwidth restrictions be addressed by changes to forms, procedures, or policies rather than just more funding. Although Universal Service cannot change program policies, clarification of policies or redesign of forms or procedures might be feasible.**

In the primary program, as mentioned, the process of funding and procedures for processing forms takes quite a while and causes cash flow concerns. Otherwise, the forms and policies are generally acceptable.

We would prefer a process more akin to the Pilot in the regular program.

- 4) Because the Primary program can support the urban/rural difference of any telecommunications service or bandwidth, are their reasons that sites needing additional bandwidth have not upgraded. Does urban rural difference funding seem to favor lower bandwidths? How? Are there scalability issues that prevent “right sizing”? For example, while T-1 is inadequate, 5 or 10 Mbps service is not available and the site cannot justify the urban rate cost step to the next available service such as bonded T-1s, DS-3, Ethernet, or a fiber connection.**

Scalability can be an issue in some locations, typically where fiber/Ethernet is not available. The remaining option of bonding T1's or stepping up to a DS3 is much more costly, even with RHC funding. Where fiber/Ethernet is available, cost per Mb is much more reasonable.

The urban rate seems to favor lower bandwidths. Our experience with DS3's is that the urban rate has been higher than the rural rate except in a few high cost locations.

- 5) Have you worked with HCPs that upgraded service? Were they previously receiving RHC support or was the upgrade made viable by starting RHC support? I am especially interested in health applications that became feasible or worked much better (distinguish) after an upgrade. Was the upgrade in bandwidth, type of service, or both? Brief summaries of bottlenecks eliminated, increased health care service delivery (the system went from 2 to 10 workstations), practitioner efficiency increased, patient volume increased, or other quantifiable benefits.**

Many sites in the regular RHC program transitioned to the FCC Pilot and upgraded to much better service. Ethernet has become more widely available in our area and we have started to transition sites to 3-10 Mbps Ethernet. Generally, Ethernet is lower cost than bonded T1's at equivalent bandwidths.

- 6) What service types (copper, fiber, DSL, MPLS, Ethernet, etc) and typical bandwidth or range of bandwidths (Mbps) are used by sites you work with.**

Avera utilizes all types of connections and services from basic internet (though this is waning) to 1.544Mbps DS1's to 1.0 Gbps fiber. As a network requirement, when available, MPLS services are utilized on top of the DS1, DS3, or Ethernet lines. The most common lines in the Avera network are DS1's and 5-10Mbps Ethernet.

- 7) Following is a list of common health services. If possible, please estimate the bandwidth used or appropriate for a site to offer that service. Best guesses are fine...but please note if you have actual experience to support the number. The first two items are regular and HD video conferencing. Some**

**health services may have the same needs as video conferencing, in which case just write video or HD video. The first column asks what minimal bandwidth could support a service. The second column seek typical shared bandwidth for all services at a facility...so if video consulting, radiology, and administration share a DS-3...all three uses would list DS-3 in column 2, although only radiology may need DS-3. That is, shared bandwidth may be less than the sum of individual application bandwidths. If you have multiple clinic scenarios with different bandwidths, list the most common or list them on another page. If you keep records to show how bandwidth is shared, please note. If more bandwidth is needed than currently used or available or you plan an upgrade in the near future, please put that in column 3. Column 3 assumes cost is not an issue, but please don't future proof or include a growth factor to list everything as 10 Gbps. I just want to know what is currently used and if it is currently inadequate.**

The question appears to be mainly telehealth based. We are going to answer in a slightly different manner. Our network, while fully utilized for the provision of health services, is not strictly telehealth based. Avera utilizes the network for eCare services (<http://www.avera.org/ecare/index.aspx>), EMR, internet access and internal communications (both voice and electronic). We utilize our network for virtually all of the listed services in the attached checklist, maybe not dentistry, and while we do provide a good deal of telehealth, many more of them are related to our EMR and integrate into our EMR (radiology and ultrasound for example). For sites that utilize a single eCare service, a single DS1 is adequate. Smaller clinics (no telehealth) have 1.544 DS1's to 5 Mbps Ethernet as appropriate. Sites that utilize Avera's EMR and a single eCare service typically have/need 5 Mbps lines. If they utilize more than one eCare service in addition to the EMR, a 10 Mbps line is utilized. Critical Access Hospitals and larger clinics (EMR and potentially eCare services) get 10 Mbps lines. Larger Hospitals (our Regional hospitals > 100 beds) have redundant DS3's. Our Largest hospital and Data Center have redundant 1 Gbps fiber lines. One thing that has helped our network grow and gain better, more advanced services is the BTOP grant that SDN had received to install additional fiber through the area.

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**Scott Simmons**

From: Simmons, Scott [mailto:SSimmons@med.miami.edu]

Sent: Wednesday, November 23, 2011 11:59 AM

Bill,

I enjoyed speaking with you. Since we don't really work with any sites that are beneficiaries of USAC subsidies, it wasn't appropriate for me to answer the questions in the survey. However, I completed the table at the end associated with question 7 (attached).

In general, we prefer to have HD-quality (720p min) video for any specialty telehealth service that requires physical examination or other interpretation of images (e.g. echo, pathology). This requires a minimum bandwidth of about 1 Mbps (1.024 Mbps actually is the call rate). If only face-to-face videoconferencing is required (e.g. mental health or follow-up visits without visual examination elements), then we use 4 CIF VTC (512-768 kbps). For educational purposes, we'll go with 384 kbps minimum (also for disaster/humanitarian applications over satellite).

We've found that real-world 3G wireless is not sufficient for HD VTC for telemedicine. We've been testing 4G LTE (Verizon) lately, and it provides adequate bandwidth for 720P HD VTC.

Let me know if you need anything else.

Best Regards,

Scott

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Scott C. Simmons

Director of TeleHealth

University of Miami Miller School of Medicine

<b>Health Care Use or Service</b>	<b>Minimum bandwidth (Mbps)</b>	<b>Typical bandwidth (Mbps)</b>	<b>Optimal Bandwidth (Mbps)</b>	<b>Comments</b>
Video Conferencing (non-HD)	0.384	0.768	1.024	
Video Conferencing (HD)	1.024	1.024	1.544	
Administrative Use				Standard-Def (non-HD)
Cardiovascular/Echo				HD



<b>Health Care Use or Service</b>	<b>Minimum band-width (Mbps)</b>	<b>Typical band-width (Mbps)</b>	<b>Optimal Bandwidth (Mbps)</b>	<b>Comments</b>
cardiology				
Dentistry				HD
Dermatology				HD
Dialysis/ESRD				N/A
Electronic Medical Records				N/A
Emergency Rm/Trauma Care				HD
Gastroenterology				HD
Obstetrics/Gynecology				HD
Orthopedics				HD
Pathology				HD
Physical Therapy				N/A
Primary Care				HD
Psychiatry & Counseling				Standard-Def (non-HD)
Radiology - MRI/CAT				HD
Radiology - X-ray				HD
Rehabilitation				HD
Remote Monitoring				N/A
Specialist Care				HD
Speech Therapy				HD
Training/Education				Standard-Def (non-HD)
Ultrasound				HD

**Eugene Sullivan**

**As someone who works with many health care providers (HCPs) receiving Universal Service support under the Rural Health Care program, I would appreciate your thoughts or experience concerning the issues below. Please call me if you want to talk instead of writing or if my questions are unclear. If you are active in both the Primary and the Pilot programs, please provide two sets of answers, if they differ.**

- 1) Have you encountered situations where the level of telecommunications or information services that sites need is unavailable? For example, no local carrier offers the service or the needed bandwidth at any cost. Please describe.**

As part of the Pilot Program we had two sites in the Northern Neck region of Virginia that did not receive any bids. When we then reached out to local providers only one responded for one of the sites and it was Verizon. The Pilot allows us to receive support for 5 years. Verizon would only sign a 3 year contract. This site will lose out on Pilot support for two years.

- 2) Have you encountered situations where the needed level of service is available but even with RHC support, prohibitively expensive? Have you helped sites scale back on requested service to stay within budget? What problems were caused by bandwidth limits that additional Universal Service funding might solve?**

When working with our partners we always look at the bandwidth needs first. We try not to over build the system but rather asked for what we need now and in the near future. There are many sites in Virginia that absent USF support would not be able to afford the bandwidth they need.

- 3) Same as question 2, but could bandwidth restrictions be addressed by changes to forms, procedures, or policies rather than just more funding. Although Universal Service cannot change program policies, clarification of policies or redesign of forms or procedures might be feasible.**

The Primary Program should be like the Pilot and provide a percentage support rather than in most cases the Urban Rural difference. Urban Rural becomes challenging for a number of reasons. 1. You have to go out and seek the best Urban rate. The Safe Harbor provided by USAC is not the best rate, in most cases. 2. When you have services like a T1 PRI line you have to make sure that all your charges for which you are seeking support are also included in the Urban rate for the T1 PRI. For example a T1 PRI bill might include "Digital Transport Facility" and Caller ID with Name". Very confusing. A flat percentage of say 70 or 75% would be a lot simpler and encourage more participation.

- 4) Because the Primary program can support the urban/rural difference of any telecommunications service or bandwidth, are their reasons that sites needing additional bandwidth have not upgraded. Does urban rural difference funding seem to favor lower bandwidths? How? Are there scalability issues that prevent “right sizing”? For example, while T-1 is inadequate, 5 or 10 Mbps service is not available and the site cannot justify the urban rate cost step to the next available service such as bonded T-1s, DS-3, Ethernet, or a fiber connection.**

Yes and again that is why the percentage support is more attractive.

- 5) Have you worked with HCPs that upgraded service? Were they previously receiving RHC support or was the upgrade made viable by starting RHC support? I am especially interested in health applications that became feasible or worked much better (distinguish) after an upgrade. Was the upgrade in bandwidth, type of service, or both? Brief summaries of bottlenecks eliminated, increased health care service delivery (the system went from 2 to 10 workstations), practitioner efficiency increased, patient volume increased, or other quantifiable benefits.**

The HCP's that I have worked with have all been receiving USF support and factored that in as they planned and then implemented upgrades. At the UVA Clinic in Orange, VA they went from 1 T1 to 3 T1's now to 6 T1's. This has allowed them to offer Radiology and Mammography services. We are now looking, as part of the Pilot to install a 20Meg Ethernet connection. The Pilot will help pay for the pulling of the fiber to the facility which we could not afford without the support.

- 6) What service types (copper, fiber, DSL, MPLS, Ethernet, etc) and typical bandwidth or range of bandwidths (Mbps) are used by sites you work with.**

We cover the full range from a T1 line at a small clinic to a 100Meg connection at a rural hospital that offers Telestroke and Radiation Oncology services.

- 7) Following is a list of common health services. If possible, please estimate the bandwidth used or appropriate for a site to offer that service. Best guesses are fine...but please note if you have actual experience to support the number. The first two items are regular and HD video conferencing. Some health services may have the same needs as video conferencing, in which case just write video or HD video. The first column asks what minimal bandwidth could support a service. The second column seek typical shared bandwidth for all services at a facility...so if video consulting, radiology, and**

administration share a DS-3...all three uses would list DS-3 in column 2, although only radiology may need DS-3. That is, shared bandwidth may be less than the sum of individual application bandwidths. If you have multiple clinic scenarios with different bandwidths, list the most common or list them on another page. If you keep records to show how bandwidth is shared, please note. If more bandwidth is needed than currently used or available or you plan an upgrade in the near future, please put that in column 3. Column 3 assumes cost is not an issue, but please don't future proof or include a growth factor to list everything as 10 Gbps. I just want to know what is currently used and if it is currently inadequate.

Health Care Use or Service	Minimum bandwidth (Mbps)	Typical bandwidth (Mbps)	Optimal Bandwidth (Mbps)	Comments
Video Conferencing (non-HD)	1	1.5	10	
Video Conferencing (HD)	2	2	20	
Administrative Use				
Cardiovascular/Echo cardiology				
Dentistry	1	1	1	
Dermatology	2	2	10	Better with HD
Dialysis/ESRD				
Electronic Medical Records				
Emergency Rm/Trauma Care	10	10	100	
Gastroenterology				
Obstetrics/Gynecology	1.5	2	10	Better with HD
Orthopedics				
Pathology				
Physical Therapy				
Primary Care				
Psychiatry & Counseling	1.5	2	20	

<b>Health Care Use or Service</b>	<b>Minimum band- width (Mbps)</b>	<b>Typical band- width (Mbps)</b>	<b>Optimal Bandwidth (Mbps)</b>	<b>Comments</b>
Radiology - MRI/CAT	10	20+	100	
Radiology - X-ray	10	20+	100	
Rehabilitation				
Remote Monitoring	10	10	100	eICU monitoring
Specialist Care				
Speech Therapy	1.5	2	10	
Training/Education	1.5	1.5	10	
Ultrasound				

If a service has the same requirements as video conferencing, just write video or HD video.

## **Mike O'Connor - Review of bandwidth Application for Health Care Sites**

### **Indicators of Bandwidth Requirements at Clinic Locations**

The primary indicator of bandwidth requirements at the clinic level are the number of doctors practicing at the location. The bandwidth needed for general applications is approximately 10M of bandwidth for 1-3 doctors and add additional 10M per groups of 1-3 doctors.

The secondary indicator of bandwidth is specialized applications. High resolution video consultation requires from 5-10M of additional bandwidth. Mobile MRI units require 10M -20M of bandwidth to provide the speed needed to send the images to a consultant and provide timely results to the patient for referral; approximately 15-25 minutes. Therefore, the bandwidth needed at a clinic level will fall within 10M to 50M. As noted above, bandwidth is proportional to the amount of data needed to be sent within a specified time period.

The clinic bandwidth calculations were based on reviewing 100+ clinic cites and follow-up discussions with IT Management.

### **Locations with less than 10M**

Not all clinic locations are being provided the minimum 10M of bandwidth. When Metro Ethernet/IP – Fiber connections are not available, the default is available Telco services at the T-1 (1.5M) or T-3 (45M) levels. T-1 services still provide connectivity to smaller sites either as a single connection or bonded to provide a 3.0M or 4.5M integrated service.

Clinics and the host hospitals are reluctant to commit to a multi-year dedicated T-3 connection as the bandwidth clearly exceeds the current needs and the associated monthly costs are significantly higher versus a T-1 or multiple T-1s. The hope is high speed affordable IP/Fiber connections will continue to expand into more and more of the rural areas.

### **Hospital and Regional Health Centers**

While the bandwidth from a clinic to the hospital can be quantified, the bandwidth required at the hospital and regional levels can quickly reach 1G of required bandwidth. The incremental bandwidth needs based on the increase in staff levels at the hospital can quickly be overshadowed by specialized high bandwidth applications such as PACS. The good news is the hospital and regional centers tend to be physically located in larger population centers and have access to high speed networks via the Telco and Cable providers.

### **Location, Location, Location**



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IT Management tends to be a cautious group. If affordable high speed access is available, then the choice is simple and clear. And while the program will pay a majority of costs, there is underlying need to not over buy or indulge in purchasing services that cannot be justified.